Portable Petrol (Gasoline) Desalinator Operation Manual

Rainman Technology Pty Ltd

www.rainmandesal.com

Operation Manual v1.5p

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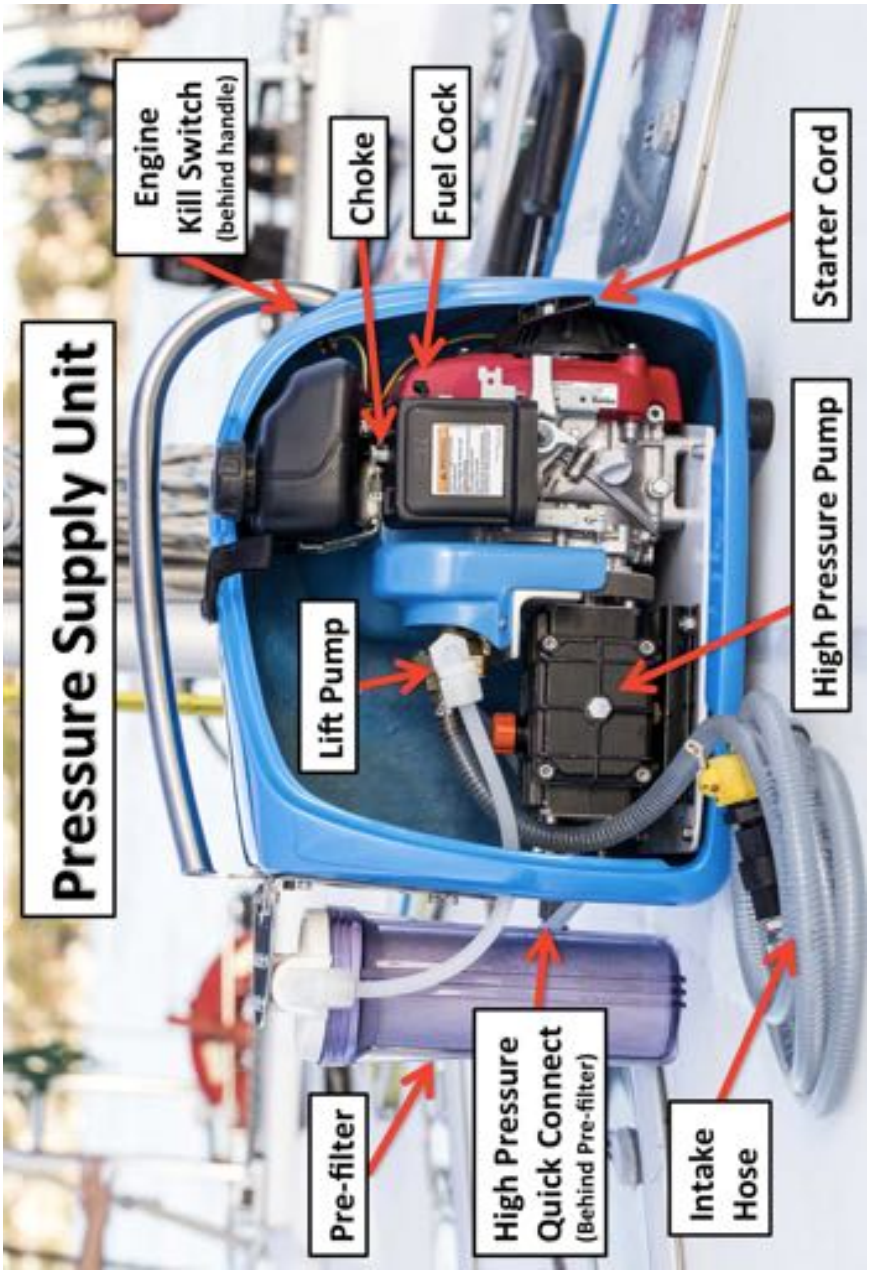
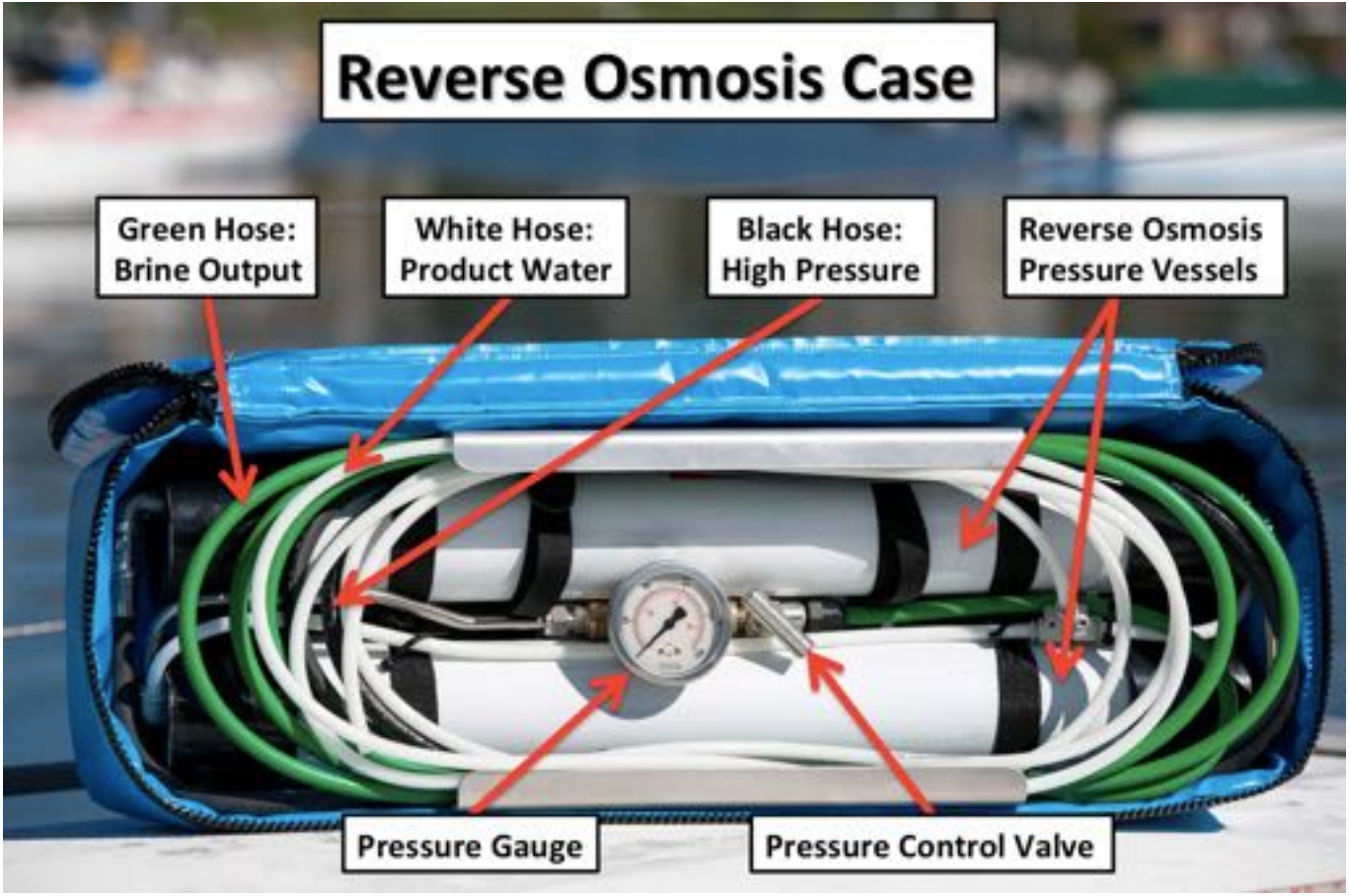
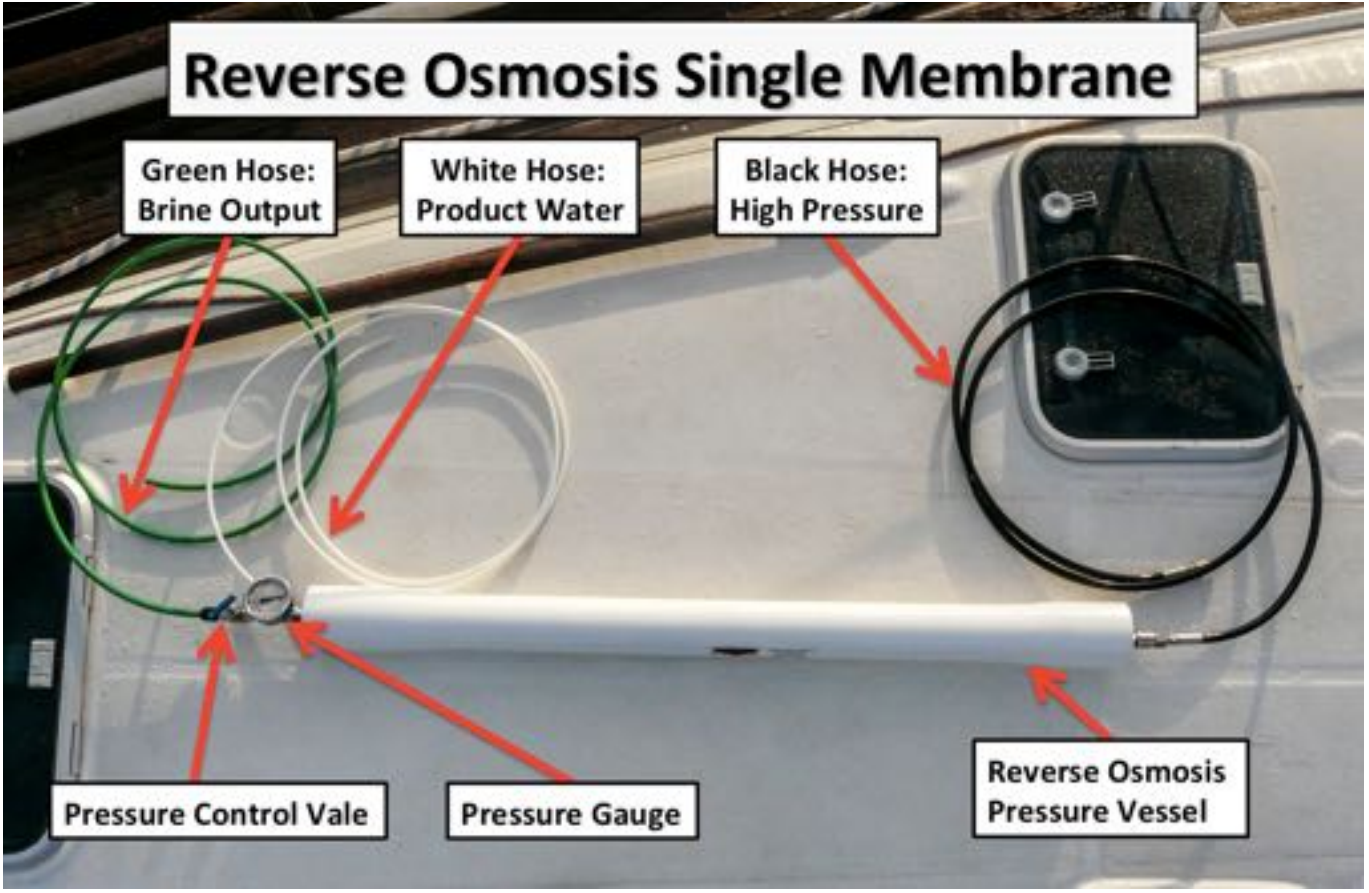
Getting To Know Your System




Reverse Osmosis Case
Green Hose: Brine Output
White Hose: Product Water
Black Hose: High Pressure
Reverse Osmosis Pressure Vessels
Pressure Gauge
Pressure Control Valve

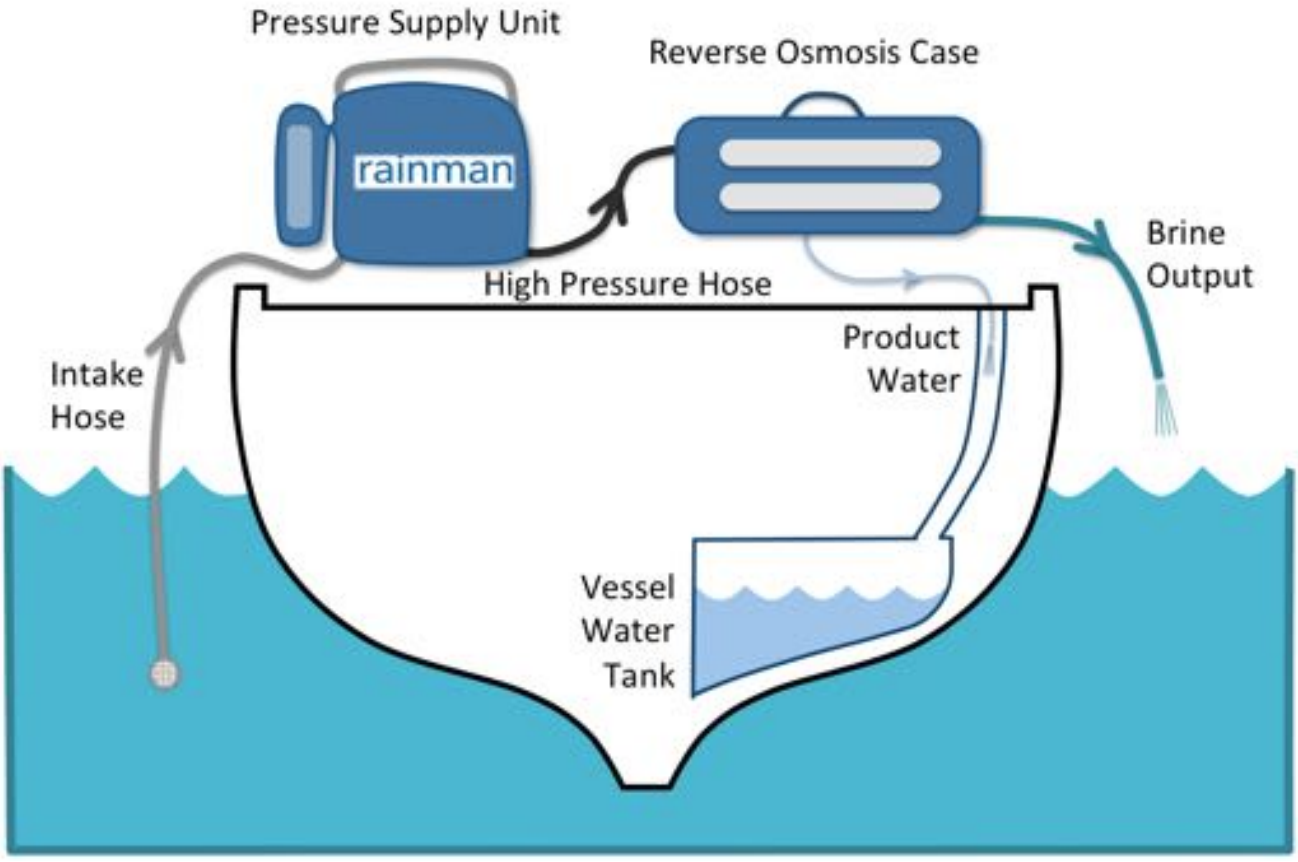

Reverse Osmosis Single Membrane
Green Hose: Brine Output
White Hose: Product Water
Black Hose: High Pressure
Pressure Control Vale
Pressure Gauge
Reverse Osmosis Pressure Vessel

How The System Works

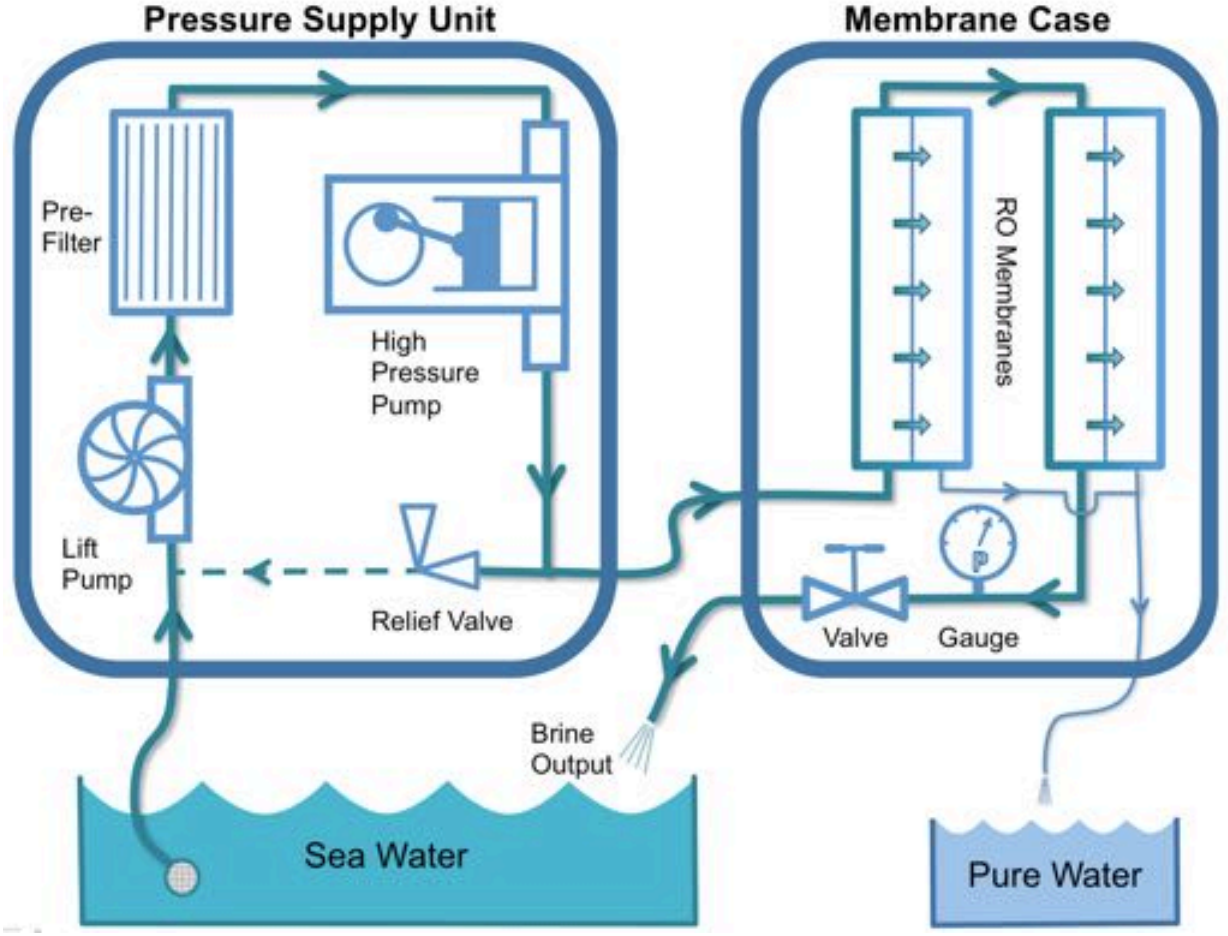
The following two diagrams give an understanding of how your desalination system operates.

1. An impeller lift pump draws sea water up to the main unit and creates positive pressure for the high-pressure pump.
2. The pre-filter removes particulates of up to 5 micron from the water.
3. A high-pressure pump delivers high-pressure in the system for the reverse osmosis membranes to operate.
4. The relief valve only opens if the control valve is closed excessively or a pressure washer gun is attached and idle.
5. A high-pressure hose carries filtered water to the reverse osmosis membranes.
6. Multiple RO membranes are connected in series (or a single RO membrane).
7. The manual control valve at the end of the system is used to set system pressure to approximately 55 bar (800 psi).
8. Brine water is released to the sea while fresh water is routed to your drinking water tank.
9. Both the lift pump and high-pressure pump are powered by a reliable Honda 50cc engine.

Rainman System Concept



System Schematic



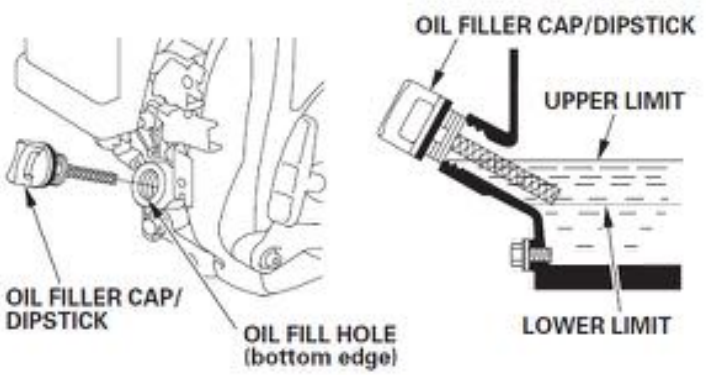
Setting Up Your New System

Thank you for purchasing a Rainman portable desalination system. We hope you enjoy the simplicity of the system and have great adventures for many years to come. Please read this entire manual prior to using the system.

Getting Started

If your Rainman desalinator was delivered by freight and not picked up from a dealer, the Pressure Supply Unit will arrive with the engine oil sump and fuel tank dry and the pressure pump will have a leak-free travel plug fitted. If your desalinator arrived by freight, follow these instructions.

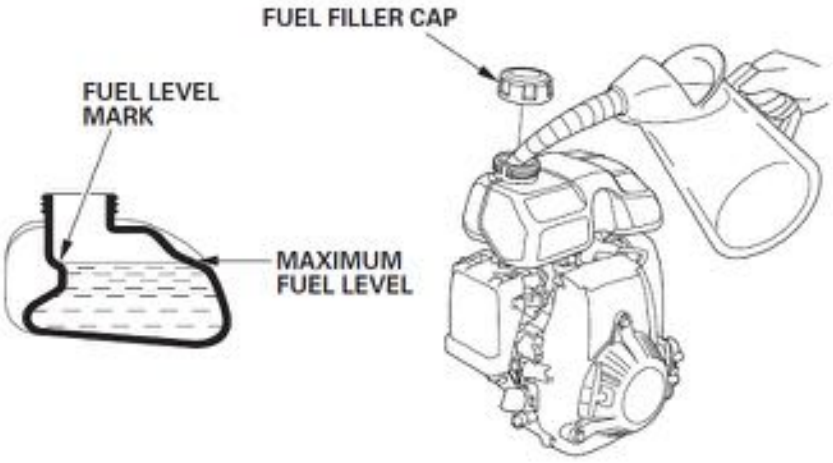
1. Fill the engine with 200 ml (.21 US Qt) of grade 10W-30 or SAE30 motor oil.



2. Remove the hex oil plug from the high-pressure pump and replace with the supplied breather plug. The breather plug has the world “OIL” on it. Save the travel plug in case the unit needs to be posted in the future.

3. The reverse osmosis membranes inside the reverse osmosis unit are supplied immersed with a preservative (pickled). This preservative can cause gastro-intestinal upset if not flushed. The system will need to be run for at least 30 minutes before product water is consumed.

Fuel Tank Filling



1. Remove the cover on the Pressure Supply Unit.
2. With the engine stopped and the unit on a level surface, remove the fuel cap.
3. Check the fuel level. If the level is low, fill the fuel tank to the bottom of the fuel level mark. Do not overfill (past the maximum fuel level shown). Refill carefully to avoid spilling fuel. Premium fuel is recommended. Do not use fuel that contains ethanol.

   ⚠ **Wipe up any spilled fuel before starting the engine.**

4. After refuelling, tighten the fuel cap securely.

   ⚠ **For more information about the Honda motor, consult the provided Honda owner's manual.**

Operating The Desalinator

This section explains how to operate the system on a regular basis, including set up, starting, stopping, and flushing the system.

Setting Up For Use

1. Place the Rainman Pressure Supply Unit (PSU) and Reverse Osmosis (RO) Unit in a stable place on the deck of your vessel. A swim platform is an ideal location.

⚠ **Make sure the PSU is no more than 2 metres (6 feet) above water level. The unit will work best operating as close to water level as possible.**

2. Unzip the cover on the Reverse Osmosis (RO) unit. Remove and uncoil the three hoses from the RO unit. Connect the black high-pressure hose to the Pressure Supply Unit.

3. Open the Pressure Supply Unit by removing the front cover.

4. Remove the clear plastic spiral intake hose from inside the Pressure Supply Unit and remove the cap.

⚠ **Starting the unit with the cap in place will damage the pumps.**

5. Place the intake hose in the source water.

⚠ **Make sure the intake hose is submerged and is not on the sea floor or among seaweed, which can cause blockage.**

6. Place the green brine output water hose in the source water.
7. Place the white product water hose on the deck of your vessel.

⚠ **Make sure the product water hose is NOT initially in your fresh water tank.**

8. Make sure the pressure valve in the reverse osmosis unit is in an open position (fully anti-clockwise).

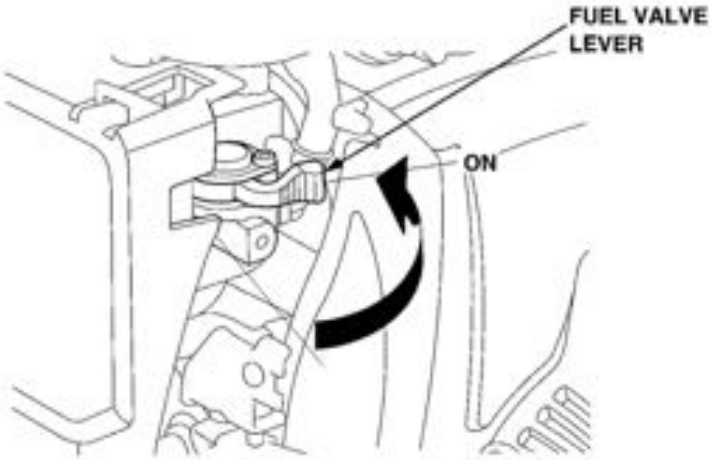
⚠ **Never allow water containing chlorine to enter your desalinator. That includes town or tap water, which contains chlorine. Chlorine damages RO membranes.**

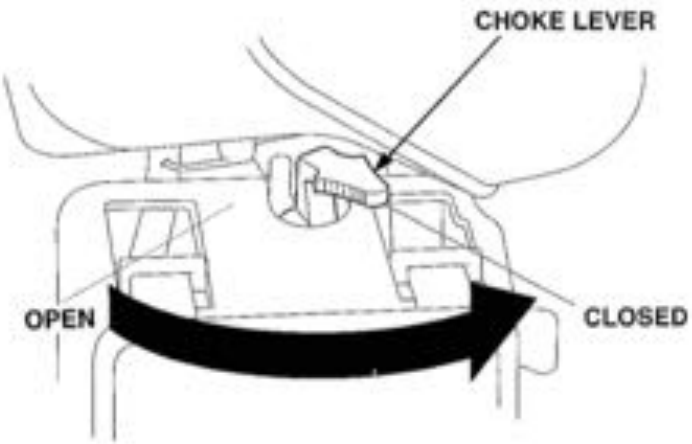
⚠ **Never run the unit dry. You will damage the pumps.**

⚠ **Never start the motor in an enclosed space.**

Starting The System

1. On the engine, switch the fuel valve lever to the open position (away from you) and close the choke (all the way to the right).





2. Pull the cord to start the engine. As the engine warms, gradually adjust the choke until the engine runs smoothly.

3. Water will start flowing out the green brine output hose.

4. Very gradually close the pressure control valve on the reverse osmosis unit by turning clockwise until the pressure gauge reads 55 bar (800 psi). The correct pressure is indicated by the green area on the pressure dial. For maximum membrane life, raise the pressure no more than 20 bar (300psi) a minute. Within 15 seconds water will start flowing out the white product hose.

⚠**Never exceed 58 bar (850 psi). If you over tighten the pressure control valve, a relief valve in the Pressure Supply Unit will release and water will recirculate within unit. This prevents damage to the RO membranes from excess pressure. However, prolonged operation of the relief valve can damage the unit.**

⚠ **If you are using your desalinator for the first time, run for at least half an hour to flush all preservatives from the system.**

5. Every time you use the unit, let fresh water flow out the product hose for approximately 30 seconds to ensure any residual salt in the system is washed away. You should test the product water at this point with a salinity meter or by taste.

6. If the product water is pure, put the product water hose in a fresh water tank and allow the system to run uninterrupted until full. Check the pressure gauge approximately every ten minutes and adjust the pressure if necessary to 55 Bar (800 psi).

7. Use the white 10 metre product water extension hose if necessary to fill multiple tanks without the need to move the desalination system.

We recommend you replace the cover on the Pressure Supply Unit during operation. When replacing the cover, take care to ensure the intake hose is placed in the indentation on the bottom left hand corner of the cover.

The 0.7 litre (0.2 gallon) tank should allow the unit to run for approximately 70 minutes.

If you stop the machine, or it stops due to low fuel, and you intend to start it again within the next 30 minutes it is advisable to remove the lid to prevent excess heat buildup inside. Excess heat buildup inside can cause fuel in the carburetor to vaporise, meaning that the machine will be hard to start again until it has cooled down.

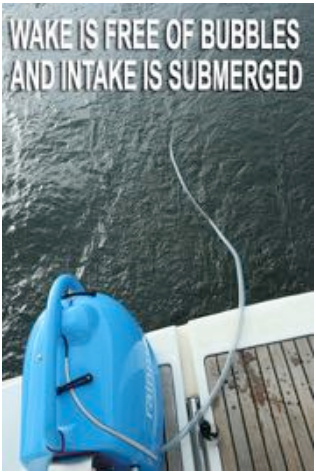
Product water flow will vary depending on temperature and salinity. The warmer the water, the more fresh water will be produced. The higher the salinity, the less fresh water will be produced.

Desalinating While Under Way

Your Rainman desalinator can be operated while under way. The recommended method is to install a dedicated through-hull fitting in a position that will always be under water in all angles of heel.

The Pressure Supply Unit will need to be placed securely and protected from getting wet. The green brine hose is then securely directed overboard.

Some owners have reported success in using their watermaker while under way without a dedicated through hull by trailing the intake hose in the wash at the stern of their vessel. It is important to ensure the end of the hose is fully submerged in such a way that it doesn't create turbulence and suck air.



We recommend sliding the intake cap up the intake hose and securing it on board the vessel so that the end of the intake hose can sink sufficiently below the surface.

We do not recommend using the detachable suction strainer when towing the intake hose.

Success when making water while towing the intake hose depends on the hull shape and speed of the vessel. Some vessels will be unsuitable. When trailing the intake hose, the particle filter needs to be monitored closely for air bubbles.

⚠ **If the intake hose is sucking air, you will damage the membranes and this will not be covered by warranty.**

Desalinating Brackish Water

Brackish water is water that is less salty than seawater, but more salty than fresh water. Examples include estuaries, harbours and saline aquifers (bore water). After heavy rain, some sources of seawater can become less saline.

The Rainman watermaker can be used to desalinate brackish water. A much lower pressure is needed, so when desalinating brackish water, only increase pressure until the rated fresh water production rate of your unit is achieved. The pressure can be as low as 200 PSI (13 bar).

The rated fresh water production rate for the High Output Unit (twin 40 inch membranes) is 140 litres an hour (2.3 litres a minute).

The rated fresh water production for the Compact RO Unit (twin 21 inch membrane) and the Economy RO Unit (single 40 inch membrane) is 70 litres an hour (1.15 litres per minute).

⚠ **Never exceed the rated fresh water flow of your system. You will damage the membranes and this will not be covered by warranty.**

When desalinating any source other than ocean seawater, ensure the water is not contaminated with any substance that can damage the RO membranes and/or be toxic to humans. Some examples include oil (often found in harbours, estuaries and marinas), chlorine (found in town water and runoff from town water) and mineral deposits found in bore water. If in doubt, do not use your desalinator.

Shutting Down

1. To switch the unit off, first slowly turn the pressure control valve in an anti-clockwise direction until the pressure reads less than 300 psi (20 bar).
2. Press and hold the engine kill switch until the engine stops.
3. Turn off the fuel valve lever by pulling it towards you.
4. Replace the cap on the intake hose to keep the unit primed during storage.
5. Replace the rubber boots on each of the other hoses to keep the system clean and prevent water dripping while stowed.

⚠ **Wait 60 seconds for internal pressure to dissipate before disconnecting the black high-pressure hose from the Pressure Supply Unit.**

⚠ **Make sure the exhaust has cooled before moving the unit.**

For more information, please watch the instructional video at **www.rainmandesal.com/support.html**

Freshwater Flushing

We recommend flushing your desalinator with fresh water after every use to prevent biological fouling and to rinse salt from the entire system. Freshwater flushing will prevent fouling for up to two weeks in temperate climates.

1. When the fresh water tank is full, remove the product water hose and fill an open container of water with approximately 10 litres (2.5 gallons) of fresh water.

2. Open the pressure control valve completely and switch off the unit. Remove the intake hose from the source water and place it in the open container of fresh water. Start the unit again, and with the pressure control valve remaining open, run the entire contents through the system.

3. When the bucket is almost empty, switch off your desalinator, leaving the fresh water in the system.

⚠ Never allow the bucket to run dry while the pump is running. You will damage the unit.

⚠Never flush your desalinator with water containing chlorine, which will damage the membranes. That includes town or tap water, which contains chlorine, or water from a vessel's tanks, which also may contain chlorine. Chlorine damages RO membranes.

⚠ If you plan on not using your watermaker within the next few weeks, you'll need to pickle the membranes.

Care and Maintenance

Your system is designed and built with high quality components. This section shows how to properly care for your system to ensure it lasts for many years.

Reverse Osmosis Membrane Care

The Dow Filmtec membrane or membranes in your Rainman desalinator should last between five and ten years if well cared for. The main way RO membranes are damaged is through biological growth or “fouling” on the surface of the membranes. This occurs if seawater is left sitting inside the RO pressure vessels for extended periods of time.

In temperate climates, growth can occur in less than two weeks, in tropical climates, growth can occur in as little as a few days. There are no precise times in which fouling can occur, only rules of thumb. A conservative approach to membrane care will ensure long membrane life.

Regular use of your desalinator is the most effective prevention against fouling. That means using your desalinator at least weekly in temperate climates and at least every few days in the tropics.

If unused for 2 days or less	No pickling necessary
If unused for between 2 and 7 days	Fresh water flush
If unused for between 7 and 30 days	Pickle the system
If unused for 30 days +	Pickle the system, discard the pre-filter and drain the pre-filter housing. Some pre-filters can turn black if stored too long in pickling solution.

When storing the unit for more than a month, discard the pre-filter and drain the pre-filter housing. Some marine deposits can continue to decompose even when immersed in a pickling solution

If you know you won't be using your desalinator, you can flush the unit with fresh water to prevent fouling for a week or two in cool climates, less in warmer climates. If you won't be using it for longer periods of time, the membranes can be preserved, or "pickled", using a preservative solution.

Pickling Your Desalinator

Pickling fills the membrane housings with a biocide that prevents fouling. Once pickled, membranes can be stored for six months or more.

1. To pickle your desalinator, add 5 tablespoons of Sodium Metabisulphite (SMBS) to a 10 litre (2.5 gallon) bucket of fresh water, to make a 1-1.5% solution of SMBS. After opening the pressure control valve completely, switch off the unit, remove the intake hose from the source water and place it in the open container of fresh water. Start the unit again, **keeping the pressure control valve open** and run the entire contents through the system.

2. When the bucket is almost empty, switch off your desalinator, leaving the pickling fluid in the system.

When storing the unit for more than a month, discard the pre-filter and drain the pre-filter housing.
Your desalinator is now pickled and can be stored for up to 6 months.

⚠ **Never allow the pickling solution bucket to run dry while the pump is running. You will damage the unit.**

Pickling In Cold Climates

If there is a chance that your desalinator will be exposed to freezing temperatures, you'll need to pickle the unit with Propylene Glycol, otherwise known as potable antifreeze. This will prevent damage to the unit through freezing, as well as preventing biological growth.

1. To pickle your desalinator with potable antifreeze, fill a bucket with ten litres (2.5 gallons) of Propylene Glycol. With the unit switched off, place the intake hose in the open container of potable antifreeze.

2. With the pressure control valve wide open, start the unit. Watch the brine output and switch the unit off when you see antifreeze coming out of it.

   Your unit is now protected from freezing and from biological growth for up to six months.

Cleaning and Changing The Pre-filter

Pre-filters should be changed if they become discoloured.

1. To change the pre-filter, place the Pressure Supply Unit on the deck of your vessel. Use the supplied filter wrench to remove the clear filter housing.

2. Replace the filter and then fill the filter housing with water to aid the priming of the pump.

High-pressure Pump Maintenance

General Pump recommends the high-pressure pump's crankcase oil be changed after an initial 50-hour break-in period. Oil should then be changed every 3 months or at 500-hour intervals thereafter. General Pump recommends its 100 Series oil, which is a SAE 30 weight (ISO 100), non-detergent oil.

Crankcase oil can be drained by using an oil extractor to suck the oil from the crankcase breather hole.

To refill the crankcase oil, insert a long stemmed funnel through the breather hole and add 350ml (12 ounces) of oil.

Oil levels can be checked via the clear inspection window on the front of the high-pressure pump.

Changing Engine Oil.

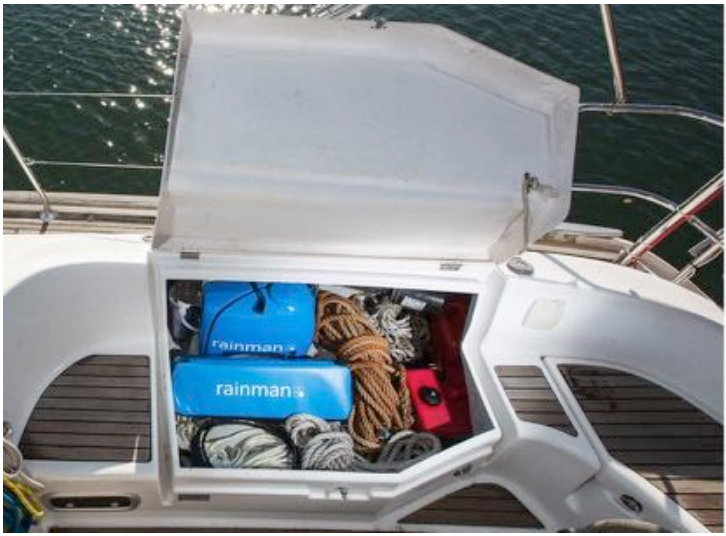
Engine oil can be drained either by tipping the unit forward or by using an oil extractor.

Jabsco Lift Pump Service

The Jabsco lift pump impeller can be accessed by removing the three bolts securing the impeller cover.

Physical Storage

Your Rainman Pressure Supply Unit has a petrol (gasoline) engine in it. In order to avoid oil draining from the sump, the system should not be inverted. Stow it securely in an upright position (below the deck of your yacht or in a locker if used in marine environment). Normal heeling of a yacht will not cause oil spillage.



Pressure Washing

By connecting the pressure washer gun (sold separately), the Rainman Desalinator becomes a powerful seawater pressure washer.

To Operate

1. Attach the pressure washer quick link hose to the Pressure Supply Unit.
2. Place the intake hose in the water.
3. Before starting, hold down the trigger on the pressure washer wand and at the same time, start the Pressure Supply Unit.

⚠ The trigger must be depressed when you start the engine.

4. When the trigger is released, water will re-circulate inside the pump to release pressure. Do not allow the motor to run for more than 30 seconds with the trigger released as the water can heat up and damage the unit.
5. Be careful using the pressure washer on delicate surfaces. The pressure washer stream is powerful and can damage some surfaces including paint and wood.
6. If you use town or chlorinated water with your Rainman pressure washer, make sure you flush it completely before using the reverse osmosis unit. The chlorine in town water will damage the reverse osmosis membranes.

Service

If your desalinator exhibits any of the following problems, stop the unit immediately and consult a qualified technician.

- Unusual noises or vibration.
- The pressure gauge will not reach 55 bar (800 psi).
- With the unit running, there is no water flow through the green brine output water hose.
- The white product hose continues to make salty tasting water after several minutes at 55 bar (800 psi).
- Major leaks of water in the Pressure Supply Unit or the RO unit.

Troubleshooting

• Symptom	• Possible Cause	• Solution
• Pressure gauge will not reach 60 bar *or* • The Pressure and/or the product amount drops	• Air in system • Fouled inlet hose • Fouled pre-filter(s) • Cavitation (Noisy operation) • Airlocked pump	• Check suction lines for leaks • Clean hose • Replace filter cartridge • Check intake lines for restrictions • Allow more time to prime and ensure that there are no air suction leaks
• Low fresh water flow	• Damaged membranes • Insufficient pressure • Cold water temperature	• Consult a qualified technician. • Make sure pressure gauge reads 55 bar (800 PSI) • Product water flow will decrease approximately 3% for each degree Celsius.

• Product water not fresh	• Damaged membrane • Insufficient time from startup • Biological fouling in pre-filter • Biological fouling in membrane	• Replace RO membrane • Allow your unit to run for up to half an hour, testing at regular intervals • Replace pre-filter • Replace membrane
• Product water flow rate higher than rated flow	• Pressure set too high • Unit operating in brackish water • Damaged RO membrane	• Decrease pressure via valve • Decrease pressure until rated fresh water flow is achieved • Replace membrane
• Excessive vibration in high-pressure hose	• Cavitation due to blockage • Airlock inside high-pressure pump	• Unblock intake hoses and pre-filter • Open pressure control valve completely until air exits system completely.

Warranty

Rainman desalinator Pressure Supply Unit and RO membrane units are guaranteed to be free of manufacturer defects and to perform within the published specifications for a period of one year from the date of shipment to the original purchaser.
In the event of a warranty claim, Rainman Technology will inspect the defective component and repair or replace at our discretion. All shipping charges are the responsibility of the purchaser to and from our office in Sydney, Australia.
The warranty is void if the system was mishandled, abused, or not operated / maintained as directed by this user manual.
Consumable items, such as the pre-filter cartridge or engine lubricant are not covered under the terms of this warranty.
Rainman Technology's liability under this warranty is limited to repair or replacement of our systems to the original purchaser.
Under no circumstances is Rainman Technology Pty Ltd liable for consequential damages related to failure of the system to perform.